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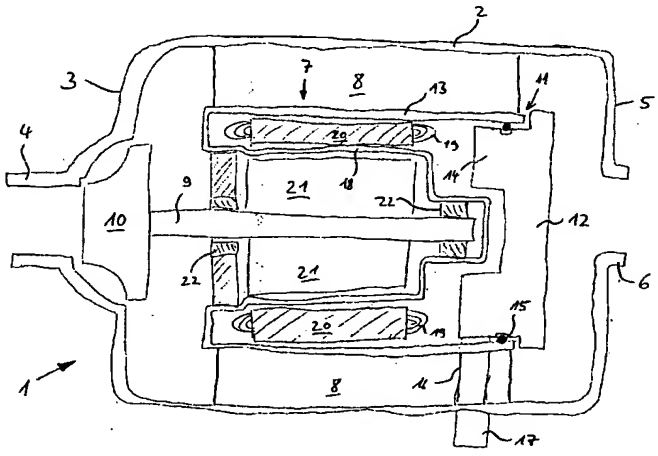
Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Der Inhalt dieser Schrift weicht von den am Anmeldetag eingereichten Unterlagen ab

(54) Rohrpumpe

(57) Die Erfindung betrifft eine Kreiselpumpe, die von einem durch eine Elektronik gesteuerten Elektromotor angetrieben ist, der vollständig innerhalb des Pumpengehäuses angeordnet ist, wobei die Elektronikeinheit (12) an der dem Laufrad (10) abgewandten Stirnseite (11) des Motorgehäuses (13) vollständig innerhalb des Pumpengehäuses (2) angeordnet ist.



DE 198 42 169 A 1

Beschreibung

Die Erfindung betrifft eine Kreiselpumpe, die von einem durch eine Elektronik gesteuerten Elektromotor angetrieben ist, der vollständig innerhalb des Pumpengehäuses angeordnet ist.

Derartige Kreiselpumpen sind als sogenannte Rohrpumpen bekannt. Bei diesen bekannten Rohrpumpen ist jedoch die den Elektromotor steuernde Elektronikeinheit außerhalb des Pumpengehäuses angeordnet, was nicht nur ein zusätzliches Gehäuse und somit zusätzlichen Bauraum erforderlich macht, sondern auch einen erheblichen Aufwand bei der Kühlung der Elektronik bedeutet.

Aufgabe der Erfindung ist es daher, eine konstruktiv einfache, preiswerte und leicht handhabbare Kreiselpumpe der eingangs genannten Art zu schaffen, die bei geringen Außenabmessungen und geringem Gewicht auf einfache Weise eine ausreichende Kühlung der Elektronik ermöglicht.

Diese Aufgabe wird erfindungsgemäß durch eine Pumpe nach Anspruch 1 gelöst.

Wesentlicher Vorteil ist dabei, daß die Elektronikeinheit vollständig innerhalb des Pumpengehäuses angeordnet ist. Dadurch wird ein separates Gehäuse außerhalb des Pumpengehäuses vermieden, so daß die Pumpe einschließlich der Elektronikeinheit einen geringeren Bauraum beansprucht und ein geringeres Gewicht aufweist. Gleichzeitig wird eine effektive Kühlung der Elektronik durch das geförderte Medium erreicht, so daß zusätzliche Vorrichtungen hierfür entfallen können. Die Pumpe ist bei einfacher Konstruktion und Montage kostengünstig herzustellen und leicht handhabbar.

Der Elektromotor kann vorzugsweise als elektronisch kommutierter bürstenloser Gleichstrommotor, aber auch als Wechselstrommotor ausgeführt sein, bei dem die Elektronik beispielsweise einen Umrichter beinhalten kann.

Besonders vorteilhaft ist es, wenn die Elektronikeinheit das Motorgehäuse an der dem Laufrad abgewandten Stirnseite abschließt und abdichtet. Dadurch kann ein separater Motorgehäuseboden eingespart werden, was zusätzlichen Bauraum und zusätzliches Gewicht einspart.

Günstig ist es ferner, wenn der Elektromotor durch Halterippen derart in einem Abstand von den Innenseiten des Pumpengehäuses entfernt, vorzugsweise mittig im Pumpengehäuse gehalten ist, daß er vom geförderten Medium rundherum umströmt wird. Dadurch wird gleichzeitig auch die Elektronikeinheit ausreichend umströmt, so daß eine optimale Kühlung erreicht wird.

Besonders vorteilhaft ist es außerdem, wenn die Kabel von der Elektronikeinheit durch mindestens eine Halterippe hindurch aus dem Pumpengehäuse hinaus geführt sind. Dadurch sind die Leitungen besonders geschützt. Hierbei kann auch ein Anschlußstecker außenseitig in dem Pumpengehäuse vorgesehen sein.

Besonders günstige Strömungsverhältnisse und eine besonders gute Kühlwirkung kann dadurch erreicht werden, daß das Pumpengehäuse eine im wesentlichen zylindrische Form hat und der Ansaugstutzen und der Druckstutzen an den gegenüberliegenden Stirnseiten des Pumpengehäuses miteinander fluchtend, vorzugsweise koaxial zur Motorwelle, angeordnet sind.

Besonders vorteilhaft ist die Verwendung eines Spaltrohrmotors als Antrieb für die Pumpe, wobei der Spalttopf in einer bevorzugten Ausführungsform einstückig mit dem Motorgehäuse ausgebildet sein kann.

Ein besonders bevorzugtes Einsatzgebiet der erfindungsgemäßen Kreiselpumpe stellt aufgrund der beengten Platzverhältnisse der Bereich der Kraftfahrzeugmotoren dar. Hierbei kann die kleinbauende Pumpe vorteilhafterweise die Kühlflüssigkeit im Kühlkreislauf des Verbrennungsmotors fördern.

Weitere Vorteile und Merkmale der Erfindung ergeben sich aus den Unteransprüchen sowie aus der nachfolgenden Beschreibung und dem in der Zeichnung dargestellten Ausführungsbeispiel.

Die Figur zeigt eine Schnittansicht einer erfindungsgemäßen Kreiselpumpe.

Die Kreiselpumpe **1** weist ein zylinderförmiges Gehäuse **2** auf, das an einer Stirnseite **3** einen Ansaugstutzen **4** und an der gegenüberliegenden Stirnseite **5** einen Druckstutzen **6** aufweist. Zentral im Gehäuse **2** ist ein Elektromotor **7** über mehrere Halterippen **8** gehalten, der über eine Welle **9** ein Laufrad **10** antreibt, welches sich unmittelbar hinter dem Ansaugstutzen **4** befindet. Der Ansaugstutzen **4** und der Druckstutzen **6** sind jeweils koaxial zur Welle **9** angeordnet.

Auf der dem Laufrad **10** abgewandten Stirnseite **11** des Elektromotors **7** befindet sich eine Elektronikeinheit **12**, in der die den Elektromotor **7** steuernde Elektronik untergebracht ist. Das Motorgehäuse **13** ist dabei an der dem Laufrad **10** abgewandten Stirnseite **11** offen ausgebildet und durch die Elektronikeinheit **12** abgeschlossen. Dazu weist die Elektronikeinheit **12** einen Absatz **14** auf, der in das Motorgehäuse **13** eingesetzt ist und über einen Dichtring **15** das Motorgehäuse gegenüber dem geförderten Medium abdichtet.

Die zur Elektronikeinheit **12** führenden Leitungskabel **16** verlaufen innerhalb der Halterippe **8** und münden in einem an der Außenseite des Pumpengehäuses **2** vorgesehen Stekker **17**.

Der Elektromotor **7** ist als Spaltrohrmotor ausgeführt, der einen Spalttopf **18** aufweist, der einstückig mit dem Motorgehäuse **13** ausgebildet ist. Die Wicklungen **19** des Stators **20** liegen somit trocken im Inneren des Motorgehäuses **13**, während der Rotor **21** mit dem geförderten Medium in Kontakt kommt, das durch die Lager **22** der Welle **9** hindurchfließen kann.

Patentansprüche

1. Kreiselpumpe, die von einem durch eine Elektronik gesteuerten Elektromotor angetrieben ist, der vollständig innerhalb des Pumpengehäuses angeordnet ist, **dadurch gekennzeichnet**, daß die Elektronikeinheit (**12**) an der dem Laufrad (**10**) abgewandten Stirnseite (**11**) des Motorgehäuses (**13**) vollständig innerhalb des Pumpengehäuses (**2**) angeordnet ist.
2. Kreiselpumpe nach Anspruch 1, dadurch gekennzeichnet, daß die Elektronikeinheit (**12**) das Motorgehäuse (**13**) an der dem Laufrad (**10**) abgewandten Stirnseite (**11**) abschließt.
3. Kreiselpumpe nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Elektromotor (**7**) durch Malterippen (**8**) derart in einem Abstand von den Innenseiten des Pumpengehäuses (**2**) entfernt, vorzugsweise mittig im Pumpengehäuse (**2**) gehalten ist, daß er vom geförderten Medium umströmt wird.
4. Kreiselpumpe nach Anspruch 3, dadurch gekennzeichnet, daß die Kabel (**16**) von der Elektronikeinheit (**12**) durch mindestens eine Halterippe (**8**) hindurch aus dem Pumpengehäuse (**2**) hinaus geführt sind.
5. Kreiselpumpe nach einem der vorherigen Ansprüche, dadurch gekennzeichnet, daß das Pumpengehäuse (**2**) eine im wesentlichen zylindrische Form hat und der Ansaugstutzen (**4**) und der Druckstutzen (**6**) an den gegenüberliegenden Stirnseiten (**3**, **5**) des Pumpengehäuses (**2**) miteinander fluchtend, vorzugsweise koaxial zur Motorwelle (**9**), angeordnet sind.

6. Kreiselpumpe nach einem der vorherigen Ansprüche, dadurch gekennzeichnet, daß der Elektromotor (**7**) ein Spaltrohrmotor ist.

7. Kreiselpumpe nach Anspruch 6, dadurch gekennzeichnet, daß der Spalttopf (**18**) einstückig mit dem Motorgehäuse (**13**) ausgebildet ist.

8. Kreiselpumpe nach einem der vorherigen Ansprüche, dadurch gekennzeichnet, daß die Pumpe (**1**) die Kühlflüssigkeit im Kühlkreislauf des Verbrennungsmotors eines Kraftfahrzeugs fördert.

Hierzu 1 Seite(n) Zeichnungen

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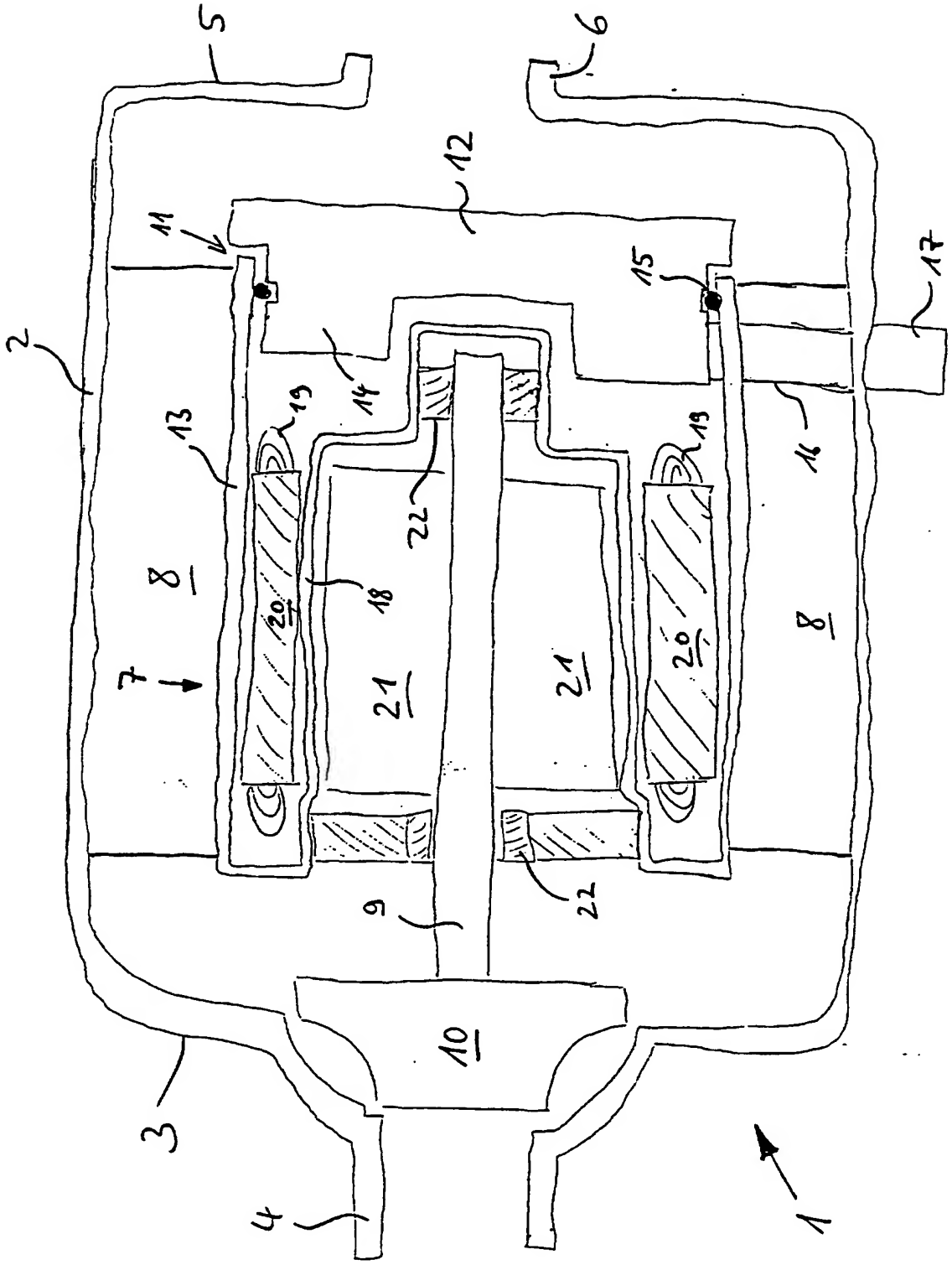

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(12) **United States Patent**
Stephan et al.

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(45) **Date of Patent: Jan. 16, 2001**

(54) **TUBE PUMP**

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(73) Assignee: **Wilo GmbH**, Dortmund (DE)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

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(22) Filed: **Sep. 14, 1999**

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(52) **U.S. Cl.** **310/87**; 417/356; 417/357
(58) **Field of Search** 310/87, 63, 54; 417/366, 356, 369, 357, 423.3

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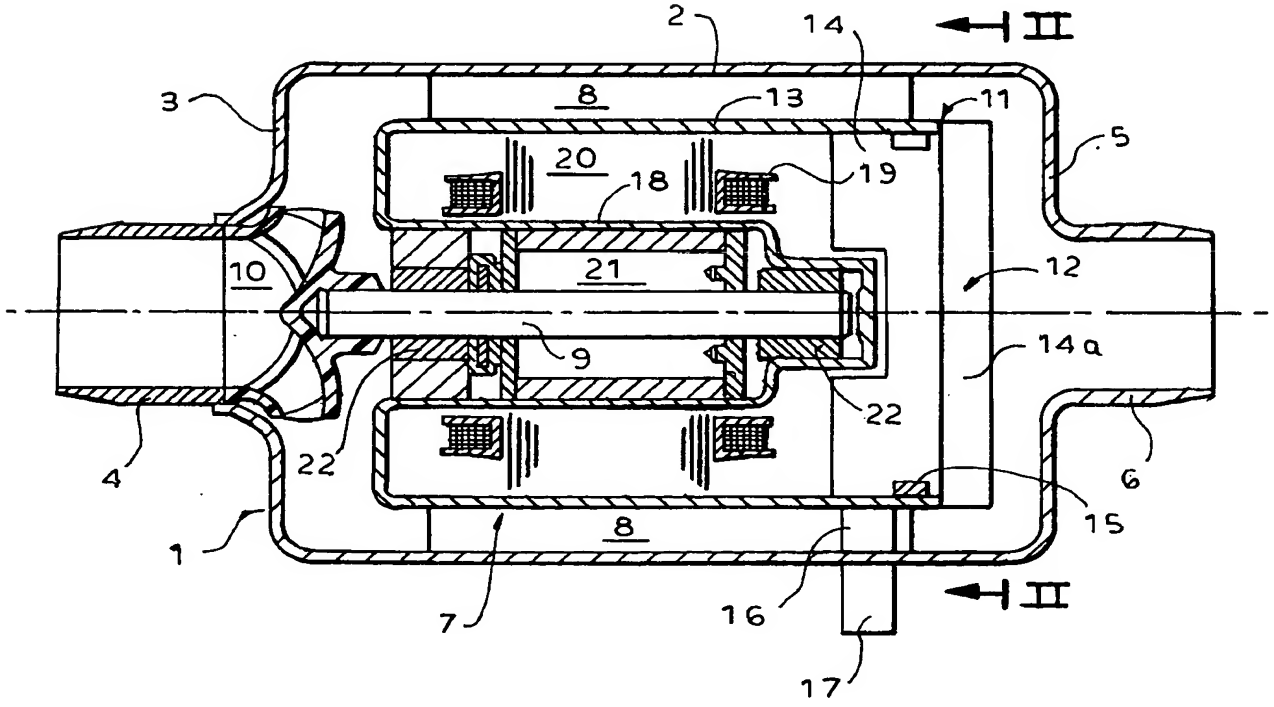
(74) *Attorney, Agent, or Firm*—Herbert Dubno

(57) **ABSTRACT**

A centrifugal pump has a housing with intake and discharge fittings at axially opposite ends. The electronic motor is supported on ribs within the pump housing and the motor casing is closed by the electronic control circuit for the motor which seals the motor against the pump liquid. The coolant thus flows around the electric motor and its control circuit.

11 Claims, 3 Drawing Sheets



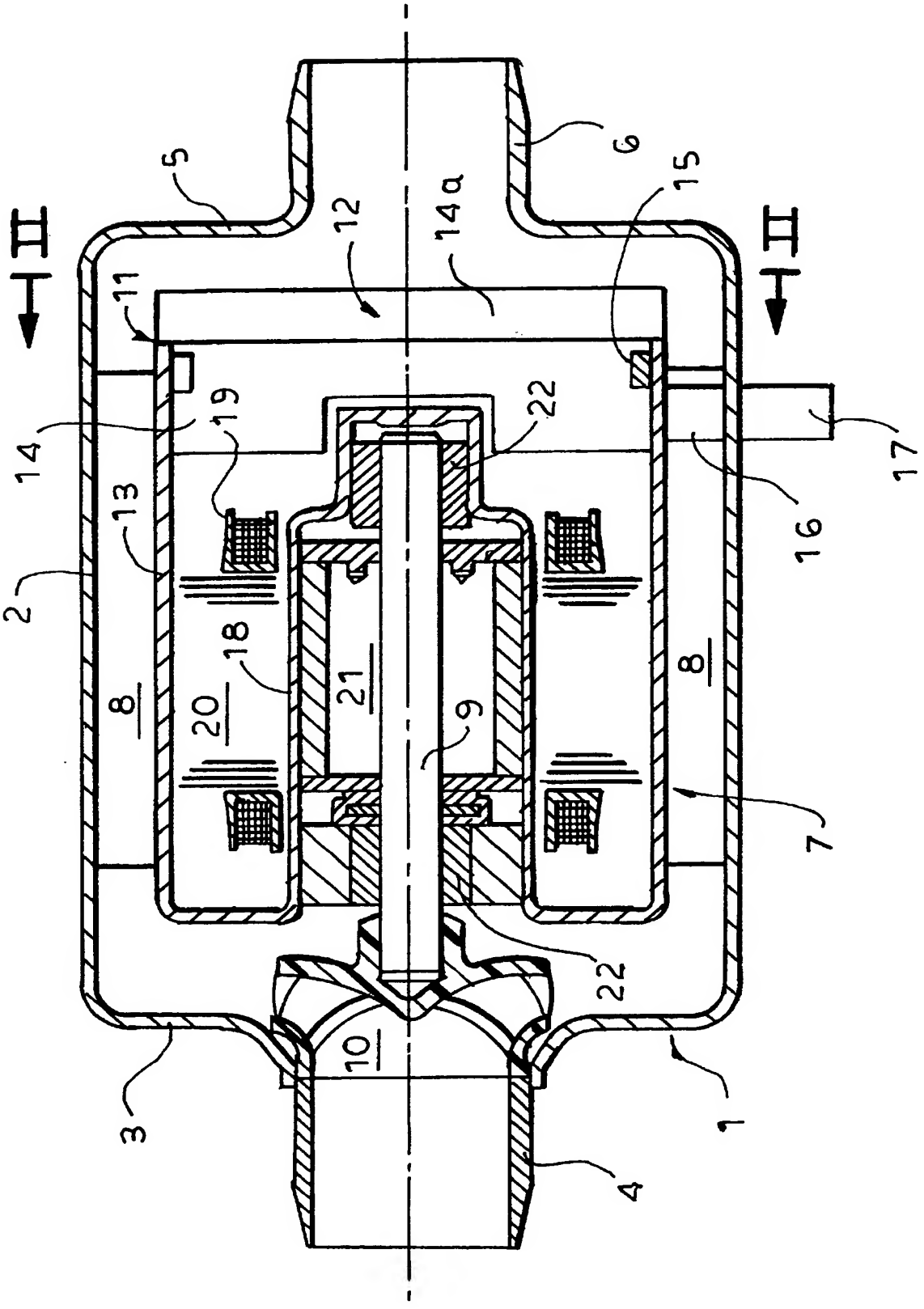


FIG. 1

FIG. 4

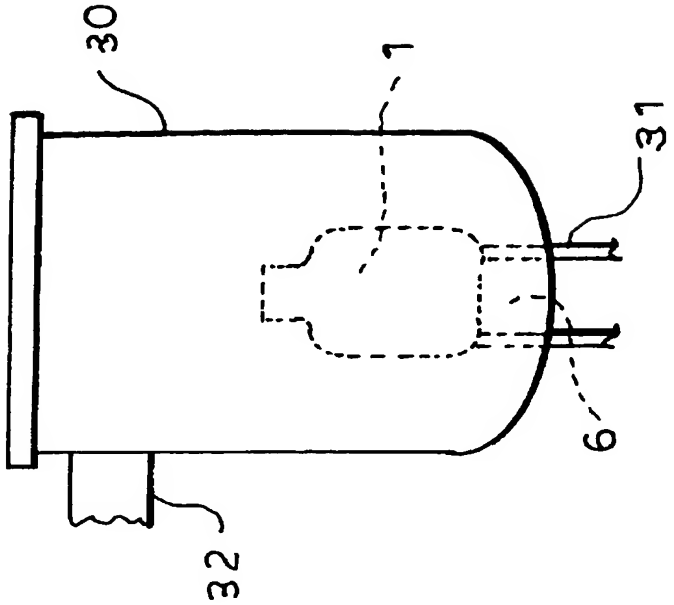


FIG. 2

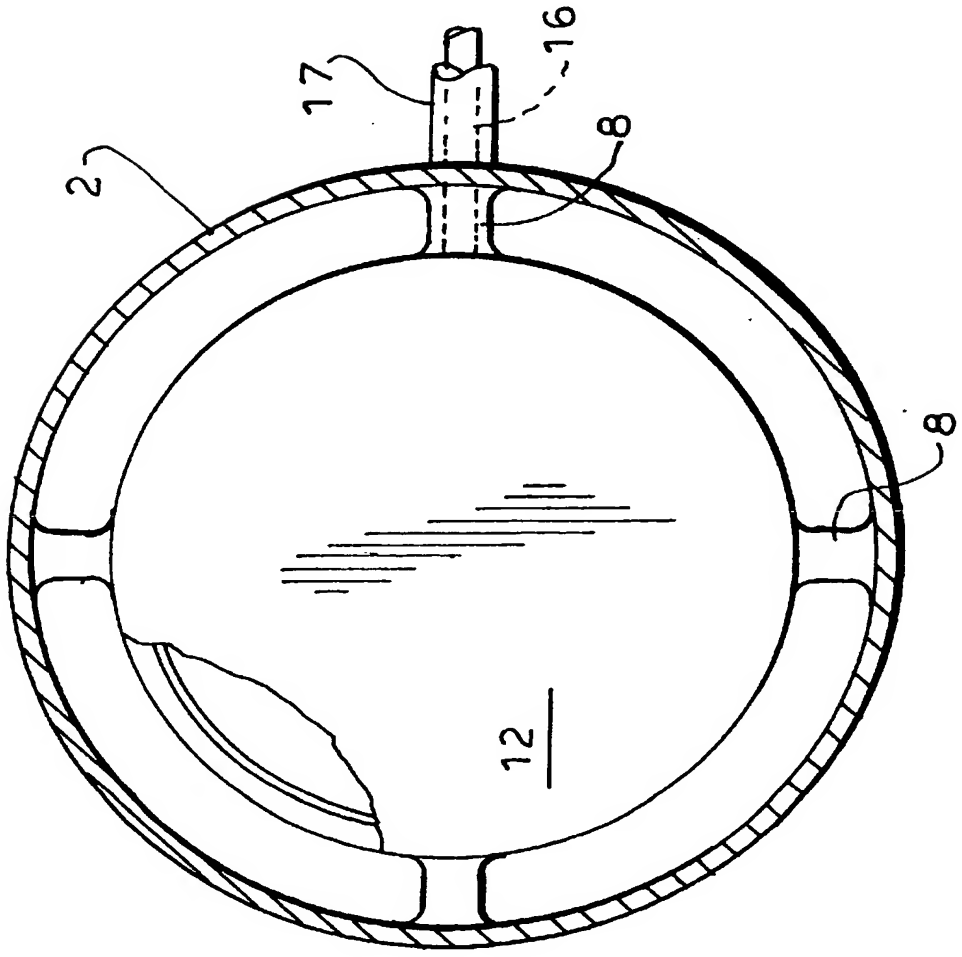
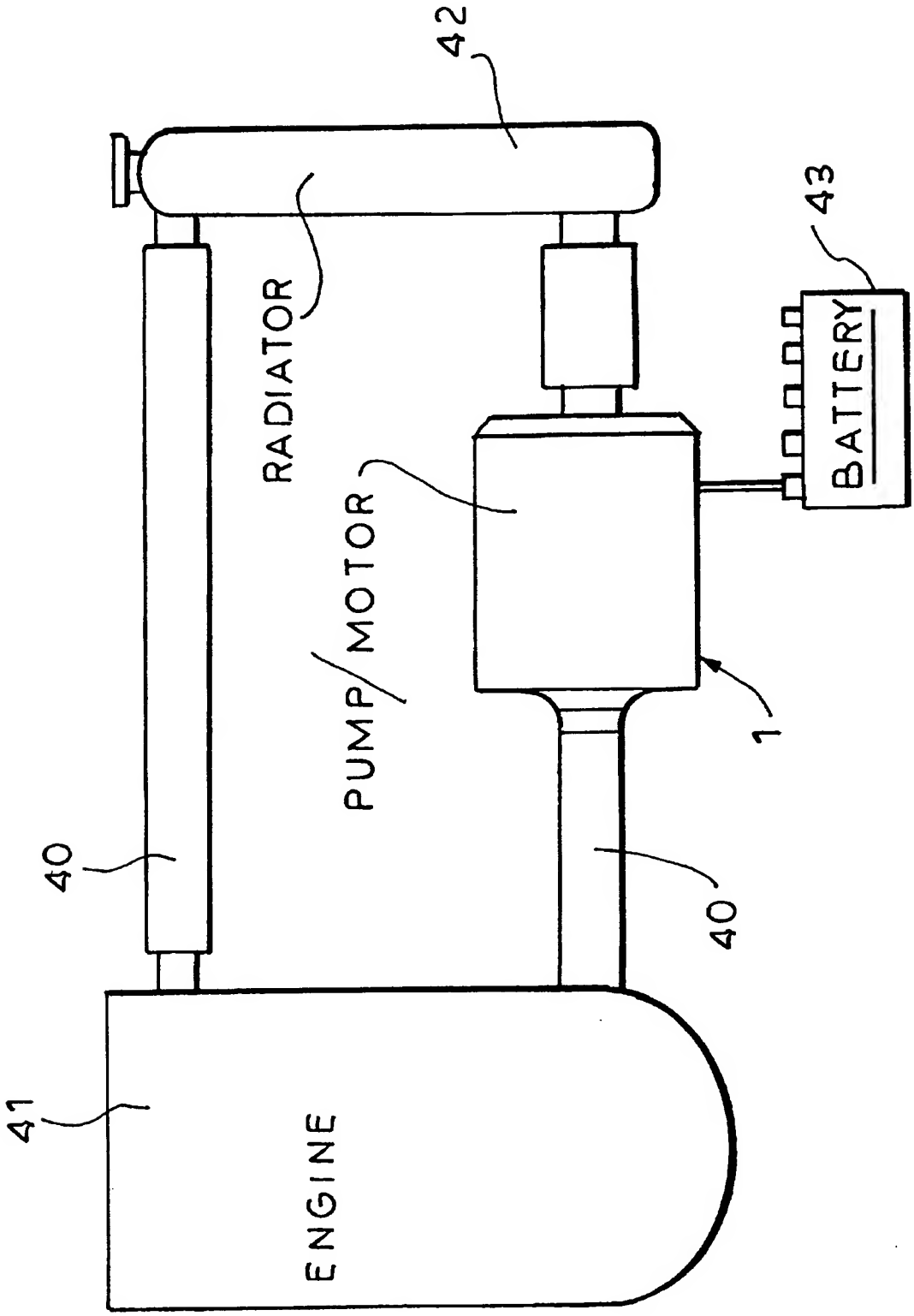


FIG. 3



TUBE PUMP

FIELD OF THE INVENTION

The present invention relates to a centrifugal pump and, more particularly, to a pump which can be built into a pipe system and which fully contains the electric motor between the pump intake and discharge fittings.

BACKGROUND OF THE INVENTION

In-line pumps which comprise a pump housing through which a liquid is displaced by the rotation of an impeller within the housing by an electric motor fully contained therein and which have intake and outlet fittings at opposite ends of the pump housing are known. The motor is supported within the pump housing by a plurality of ribs and the liquid flows around the electric motor and thus serves as a coolant for the electric motor.

Such pumps are also known as tube pumps and the electric motors of such pumps are generally provided with electric controllers which are located externally of the pump housing. The electric controls thus require separate or additional housings and additional space which often may not be readily available. Where the electric circuitry generates heat, it may be necessary to provide separate cooling.

When it is desirable to use an in-line or tube pump of this type in a motor vehicle, these factors may be of considerable significance and may militate against use of a tube pump.

OBJECTS OF THE INVENTION

It is, therefore, the principal object of the present invention to provide a structurally simple, economical and easily handled and used centrifugal pump which has small external dimensions, light weight and efficient cooling of all parts associated with the pump including the electronic control circuitry.

Another object of the invention is to provide an in-line or tube pump which eliminates the drawbacks outlined above.

SUMMARY OF THE INVENTION

These objects and others which will become apparent hereinafter are attained, in accordance with the invention, in a centrifugal pump which comprises:

- an elongated tubular pump housing formed with an intake fitting at one axial end and a discharge fitting at an opposite axial end;
- a pump impeller rotatable in the housing about an axis thereof for drawing liquid in through the intake fitting, passing the liquid axially through the housing and discharging the liquid through the discharge fitting;
- an axially elongated electric motor wholly received in the housing between the intake fitting and the discharge fitting and flushed around by the liquid flowing between the intake fitting and the discharge fitting, the motor having a rotor rotatable about the axis and operatively connected to the impeller, a stator surrounding the rotor and provided with at least one winding, and a motor casing receiving the stator and spaced inwardly of the housing, whereby the liquid passes between the casing and the housing;
- an electronic control unit for controlling the motor, wholly received in the housing and flushed around by the liquid; and
- a plurality of angularly spaced support ribs between the housing and the casing for supporting the casing in the housing.

More particularly, the centrifugal pump of the invention contains an electric motor which is disposed entirely within the pump housing which is of the in-line type having axial inlet and discharge fittings at opposite ends thereof and in which the electric motor is supported within the pump housing at a spacing from the inner wall thereof by the support ribs. With the system of the invention, the electric control unit itself is in the form of a disk which closes the motor casing and is completely within the pump housing so that the liquid displaced by the pump flushes past that control unit.

With the system of the invention, a separate housing externally of the pump housing for the control unit is eliminated, the pump has small dimensions overall, is of light weight and has effective cooling both of the motor and of the control unit. Additional systems for cooling the electric circuitry are avoided.

The electric motor is preferably an electrically commutated brush-free direct current motor although it can also be configured as an alternating current motor in which the electric control circuitry can, for example, include a converter. The electric control circuitry can include a circuit board with a microprocessor controller, power transistors and the like.

It has been found to be especially advantageous to provide the electric control unit as a plug for an open end of the motor casing at the side thereof opposite the impeller. A single seal may be provided between the electronic control unit and the casing and can serve as the only seal for the latter. This eliminates the need for multiple seals and separate casing covers, thereby affording a further saving with respect to size and weight.

Advantageously, the motor is a so-called canned motor in which the motor can lining the inside of the stator and surrounding the rotor can be in one piece with the casing.

The cable for connection to the electric control unit can extend into the latter through one of the holding ribs and a plug connection can be provided for the conductors in a fitting on the pump housing. The conductors extending to the electric control unit are thus appropriately protected.

The in-line centrifugal pump of the invention, because of its narrow configuration, can be used highly effectively as a coolant pump for the internal combustion engine of a motor vehicle and hence in the motor vehicle coolant system.

It has long been known that the coolant in the circulation of a water cooled internal combustion engine can be circulated by a pump. In general, that pump is driven by a belt drive from the crank shaft of the internal combustion engine itself. More recently, however, it has been found to be advantageous to drive the water pump by a separate electric motor to be able to better control and regulate the cooling effectiveness.

In this case, the electric motor constitutes a component which must be accommodated in the engine compartment of the motor vehicle. In modern automotive vehicles, space is either not available in the engine compartment or is available so limitedly as to cause problems for the additional electric motor.

In addition, the high temperatures in the engine compartment make the cooling of the electronic circuitry of the electric motor especially important.

The invention accommodates the electric control circuitry directly within the housing of an in-line pump so that the pump itself is merely an extension of the piping of the coolant circulation. The pump is thus accommodated in a space-saving manner and, because the electronic controlled circuitry is located within the pump housing, cooling of the

circuitry is simplified. The pump may also be accommodated within a container of the coolant circulation system, for example, a surge container or reservoir.

According to another feature of the invention, the noise generated by the pump is damped by the circulation of the liquid through the pump. It has been found to be especially advantageous to form the pump housing as a part of the piping for the circulation system so that the pump with the electronic motor and the electronic controlled unit are all completely received within the piping of the coolant circulation. The piping in the region of the pump will only have an increase in the pipe diameter. Special space for the pump and its electric controlled unit is not required.

When the pump is located in a surge vessel of the cooling circulation, that vessel may be dimensioned sufficiently so that the pump and its motor are fully contained within that container. This insures an especially effective cooling of the pump electronics.

It is also advantageous to mount the pump releasably in the surge container, i.e. so that it can be easily removed and inserted. This facilitates mounting and dismounting, e.g. for maintenance.

BRIEF DESCRIPTION OF THE DRAWING

The above and other objects, features, and advantages will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. **1** is an axial cross section through a pump according to the invention;

FIG. **2** is a cross sectional view along the line II—II of FIG. **1**, partly broken away;

FIG. **3** is a diagram showing the pump in a motor vehicle coolant circulation system; and

FIG. **4** is a diagram of a surge tank of another motor vehicle coolant system provided with the pump of the invention.

SPECIFIC DESCRIPTION

The centrifugal circulating pump **1** shown in the drawing comprises a cylindrical pump housing **2** which is formed at one end **3** with an intake fitting **4** and at the opposite end **5** with a discharge fitting **6**. Disposed centrally within the housing **2** and coaxially therewith is an electric motor **7** which is supported on ribs **8** and which has a shaft **9** connected to and driving the impeller **10**. The latter is located directly downstream of the intake fitting **4**. The intake fitting **4** and the discharge fitting **6** are coaxial with the shaft **9**.

The end **11** of the motor casing **13** opposite the side of the motor on which the impeller **10** is provided receives an electric control unit **12** which is formed as a stepped disk with the small diameter step **14** received within the casing **13** and plugging the latter. The electric control unit has a large diameter step **14***a* which is flush with the outer surface of the casing **13**. A single sealing ring **15** in a groove of the step **14** seals the interior of the casing **13** against the liquid which is displaced. Further seals are not required. The cable **16** running to the electronic control unit **12** can extend through one of the support ribs **8** and can terminate in a plug **17** at the exterior of the pump housing **2**.

The electronic motor **7** is formed as a canned motor with a cup shaped can **18** formed in one piece with the motor housing **13** and lining the inside of the stator **20** with its windings **19**. The rotor **21** of the electric motor is disposed in the space surrounded by the can **18** and the bearings **22** are supported by the can and journal the shaft **9**. As can be seen from FIG. **4**, the pump **1** can be located in a surge tank **30** of a cooling system of an internal combustion engine and the discharge fitting **6** in that case is readily removable from the outlet fitting **31** of the surge tank **30**. The coolant liquid can flow into the surge tank through the fitting **32**. The pump, moreover, and electronic unit are all completely received within the tank **30** to insure cooling of the control unit **12**.

From FIG. **3** it will be apparent that the pump can be provided as an in-line pump in the pipe **40** of a motor vehicle coolant circulation system for circulating coolant through an engine **41** and between that engine and the radiator **42** of the vehicle. The motor of the pump **1** is energized by the vehicle battery **43**. In all cases, the circulated liquid is caused to pass around the motor and the electronic control circuitry to efficiently cool the latter.

We claim:

1. A centrifugal pump comprising:

an elongated tubular pump housing formed with an intake fitting at one axial end and a discharge fitting at an opposite axial end;

a pump impeller rotatable in said housing about an axis thereof for drawing a liquid in through said intake fitting, passing said liquid axially through said housing and discharging the liquid through said discharge fitting;

an axially elongated electric motor wholly received in said housing between said intake fitting and said discharge fitting and flushed around by the liquid flowing between said intake fitting and said discharge fitting, said motor having a rotor rotatable about said axis and operatively connected to said impeller, a stator surrounding said rotor and provided with at least one winding, and a motor casing receiving said stator and spaced inwardly of said housing, whereby said liquid passes between said casing and said housing;

an electronic control unit for controlling said motor, wholly received in said housing and flushed around by said liquid;

a plurality of angularly spaced support ribs between said housing and said casing for supporting said casing in said housings and

a single annular seal between said electronic control unit and said casing and sealing said casing against an interior of said housing.

2. The centrifugal pump defined in claim **1** wherein said electronic control unit is fitted onto said casing at an end thereof opposite said impeller.

3. The centrifugal pump defined in claim **2** wherein said casing is open at said end and said electronic control unit is a plug which closes said end of said end of said casing.

4. The centrifugal pump defined in claim **1** wherein said motor is a canned motor.

5. The centrifugal pump defined in claim **4** wherein said casing is formed in one piece with a can internally lining said stator and surrounding said rotor, said can having bearings journalling a shaft carrying said rotor and said impeller.

6. The centrifugal pump defined in claim **1**, further comprising an electric cable connected to said electronic control unit and extending through one of said ribs.

7. The centrifugal pump defined in claim **1**, further comprising means for connecting said pump in a motor vehicle coolant circulation path.

8. The centrifugal pump defined in claim 7 wherein said housing forms part of a duct of said coolant circulation path so that said impeller, said motor and said electronic control unit are located wholly within said duct.

9. The centrifugal pump defined in claim 7 wherein said pump is located in a vessel forming part of said coolant circulation path.

10. The centrifugal pump defined in claim 9 wherein said pump is disposed in a surge tank.

11. A centrifugal pump comprising:

an elongated tubular pump housing formed with an intake fitting at one axial end and a discharge fitting at an opposite axial end;

a pump impeller rotatable in said housing about an axis thereof for drawing a liquid in through said intake fitting, passing said liquid axially through said housing and discharging the liquid through said discharge fitting;

an axially elongated electric motor wholly received in said housing between said intake fitting and said discharge fitting and flushed around by the liquid flowing between said intake fitting and said discharge fitting, said motor having a rotor rotatable about said axis and operatively connected to said impeller, a stator surrounding said rotor and provided with at least one winding, and a motor casing receiving said stator and spaced inwardly of said housing, whereby said liquid passes between said casing and said housing;

an electronic control unit for controlling said motor, wholly received in said housing and flushed around by said liquid;

a plurality of angularly spaced support ribs between said housing and said casing for supporting said casing in said housing; and

a single annular seal between said electronic control unit and said casing and sealing said casing against an interior of said housing,

said motor being a canned motor,

said casing being formed in one piece with a can internally lining said stator and surrounding said rotor, said can having bearings journalling a shaft carrying said rotor and said impeller, said electronic control unit being in the form of a plug fitting into said housing.

* * * * *

Circulating pump which is driven by electric motor controlled by electronic unit which is arranged completely inside pump housing

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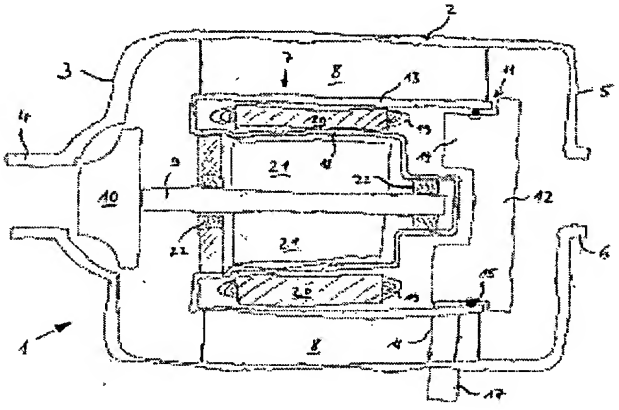
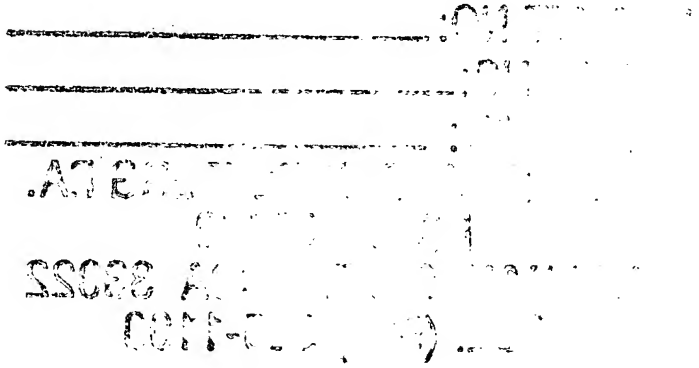
Abstract of **DE19842169**

The electronic unit (12) is arranged at the endface (11) of the motor housing (13), away from the impeller (10), completely inside the pump housing (2). The electronic unit (12) seals the motor housing (13) at the endface (10) away from the impeller (10). The pump unit has a cylindrical form and an inlet manifold (4) and pressure manifold (6) on the opposite side of the pump housing.





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